

WHAT IS CLAIMED IS:

1. A method for assessing the condition of a device, comprising:

5 receiving a plurality of signals from a sensor operable to make one or more electrical measurements of a device;

estimating an expected response of the device in accordance with the received signals;

10 establishing a measured response of the device in accordance with the received signals;

calculating an output residual according to the expected response and the measured response; and

15 assessing the condition of the device by identifying a fault of the device in accordance with the output residual.

2. The method of Claim 1, wherein the device comprises an electric device.

20 3. The method of Claim 1, wherein the device comprises an electric motor.

25 4. The method of Claim 1, further comprising monitoring the one or more electrical measurements of the device to generate the plurality of signals.

5. The method of Claim 1, wherein estimating the expected response of the device in accordance with the received signals further comprises:

5       estimating a disturbance from the received signals;  
and

      calculating the expected response in accordance with the disturbance.

6. The method of Claim 1, wherein:

10       the received signals comprise one or more measured inputs to the device and one or more measured outputs from the device; and

      estimating the expected response of the device in accordance with the received signals further comprises:

15       estimating a disturbance of the received signals;

      decoupling a first effect of the one or more measured inputs on the one or more measured outputs and a second effect of the disturbance on the one or more measured outputs; and

20       estimating the expected response of the device according to the first effect and the second effect.

7. The method of Claim 1, further comprising  
25       extracting a spatio-temporal feature from the output residual.

8. The method of Claim 1, further comprising  
30       extracting a spatio-temporal feature from the one or more electrical measurements.

9. The method of Claim 1, further comprising classifying the fault to assess the condition of the device.

5           10. The method of Claim 1, further comprising:  
          receiving an indicator corresponding to a life  
          expectancy of the device; and  
          estimating the life expectancy associated with the  
          device in accordance with the condition of the device and  
10          the indicator.

          11. The method of Claim 1, further comprising:  
          receiving an indicator corresponding to a life  
          expectancy of the device;  
15          estimating the life expectancy associated with the  
          device in accordance with the condition of the device and  
          the indicator; and  
          calculating an uncertainty associated with the  
          estimated life expectancy.

12. A system for assessing the condition of a device, comprising:

a sensor operable to make one or more electrical measurements of a device to generate a plurality of signals; and

a processor coupled to the sensor and operable to:

estimate an expected response of the device in accordance with the signals;

establish a measured response of the device in accordance with the signals;

calculate an output residual according to the expected response and the measured response; and

assess the condition of the device by identifying a fault of the device in accordance with the output residual.

13. The system of claim 12, wherein the device comprises an electric device.

14. The system of claim 12, wherein the device comprises an electric motor.

15. The system of claim 12, the sensor further operable to monitor the one or more electrical measurements of the device to generate the plurality of signals.

16. The system of claim 12, the processor operable to estimate the expected response of the device in accordance with the signals by:

5       estimating a disturbance from the signals; and  
      calculating the expected response in accordance with the disturbance.

17. The system of claim 12, wherein:

10       the signals comprise one or more measured inputs to the device and one or more measured outputs from the device; and

      the processor is operable to estimate the expected response of the device in accordance with the signals by:

15       estimating a disturbance of the signals;  
      decoupling a first effect of the one or more measured inputs on the one or more measured outputs and a second effect of the disturbance on the one or more measured outputs; and

20       estimating the expected response of the device according to the first effect and the second effect.

25       18. The system of claim 12, the processor further operable to extract a spatio-temporal feature from the output residual.

      19. The system of claim 12, the processor further operable to extract a spatio-temporal feature from the one or more electrical measurements.

30       20. The system of claim 12, the processor further operable to classify the fault to assess the condition of the device.

21. The system of claim 12, the processor further operable to:

5 receive an indicator corresponding to a life expectancy of the device; and

estimate the life expectancy associated with the device in accordance with the condition of the device and the indicator.

10 22. The system of Claim 12, the processor further operable to:

receive an indicator corresponding to a life expectancy of the device;

15 estimate the life expectancy associated with the device in accordance with the condition of the device and the indicator; and

calculate an uncertainty associated with the estimated life expectancy.

23. Logic for assessing the condition of a device,  
the logic embodied in a medium and operable to:

5       receive a plurality of signals from a sensor  
operable to make one or more electrical measurements of a  
device;

      estimate an expected response of the device in  
accordance with the received signals;

      establish a measured response of the device in  
accordance with the received signals;

10       calculate an output residual according to the  
expected response and the measured response; and

      assess the condition of the device by identifying a  
fault of the device in accordance with the output  
residual.

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24. The logic of Claim 23, wherein the device  
comprises an electric device.

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25. The logic of Claim 23, wherein the device  
comprises an electric motor.

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26. The logic of Claim 23, further operable to  
monitor the one or more electrical measurements of the  
device to generate the plurality of signals.

27. The logic of Claim 23, operable to estimate the  
expected response of the device in accordance with the  
received signals by:

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      estimating a disturbance from the received signals;  
and

      calculating the expected response in accordance with  
the disturbance.

28. The logic of Claim 23, wherein:

the received signals comprise one or more measured  
inputs to the device and one or more measured outputs  
5 from the device; and

the logic further operable to estimate the expected  
response of the device in accordance with the received  
signals by:

estimating a disturbance of the received  
10 signals;

decoupling a first effect of the one or more  
measured inputs on the one or more measured outputs and a  
second effect of the disturbance on the one or more  
measured outputs; and

15 estimating the expected response of the device  
according to the first effect and the second effect.

29. The logic of Claim 23, further operable to  
extract a spatio-temporal feature from the output  
20 residual.

30. The logic of Claim 23, further operable to  
extract a spatio-temporal feature from the one or more  
electrical measurements.

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31. The logic of Claim 23, further operable to  
classify the fault to assess the condition of the device.



32. The logic of Claim 23, further operable to:  
receive an indicator corresponding to a life  
expectancy of the device; and  
estimate the life expectancy associated with the  
5 device in accordance with the condition of the device and  
the indicator.

33. The logic of Claim 23, further operable to:  
receive an indicator corresponding to a life  
10 expectancy of the device;  
estimate the life expectancy associated with the  
device in accordance with the condition of the device and  
the indicator; and  
calculate an uncertainty associated with the  
15 estimated life expectancy.

34. A system for assessing the condition of a device, comprising:

means for receiving a plurality of signals from a sensor operable to make one or more electrical measurements of a device;

means for estimating an expected response of the device in accordance with the received signals;

means for establishing a measured response of the device in accordance with the received signals;

means for calculating an output residual according to the expected response and the measured response; and

means for assessing the condition of the device by identifying a fault of the device in accordance with the output residual.

35. A method for assessing the condition of a device, comprising:

5        monitoring at a sensor one or more electrical measurements of a device to generate a plurality of signals, the device comprising an electric device comprising an electric motor;

10        receiving the plurality of signals from the sensor, the received signals comprising one or more measured inputs to the device and one or more measured outputs from the device;

      estimating an expected response of the device in accordance with the received signals by:

      estimating a disturbance of the received signals;

15        decoupling a first effect of the one or more measured inputs on the one or more measured outputs and a second effect of the disturbance on the one or more measured outputs; and

20        estimating the expected response of the device according to the first effect and the second effect;

      establishing a measured response of the device in accordance with the received signals;

      calculating an output residual according to the expected response and the measured response;

25        assessing the condition of the device by identifying a fault of the device in accordance with the output residual by:

      extracting a first spatio-temporal feature from the output residual; and

30        extracting a second spatio-temporal feature from the one or more measurements; and

classifying the fault to assess the condition  
of the device;

receiving an indicator corresponding to a life  
expectancy of the device;

5       estimating the life expectancy associated with the  
device in accordance with the condition of the device and  
the indicator; and

calculating an uncertainty associated with the  
estimated life expectancy.

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